Cerebral palsy research news

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Interventions and Management

1. "Deconstructing" upper limb function in dyskinetic cerebral palsy

Pons Roser, Dalivigka Zoi

Editorial Eur J Paediatr Neurol. 2024 May 14:S1090-3798(24)00063-1. doi: 10.1016/j.ejpn.2024.05.005. Online ahead of print.

No abstract available

PMID: 38760305

2. Transiliac-Shortening Osteotomy to Treat Ischial Pressure Injury due to Fixed Pelvic Obliquity: A Case Report

Richard M Schwend, Brandon T Nguyen, McKenna C Noe, John T Anderson, Shao Jiang

Case Reports JBJS Case Connect. 2024 May 17;14(2). doi: 10.2106/JBJS.CC.23.00557. eCollection 2024 Apr 1.

Case: A 17-year-old adolescent boy with Gross Motor Function Classification System 5 cerebral palsy and neuromuscular scoliosis underwent posterior spinal fusion and segmental spinal instrumentation from T3 to the pelvis. He developed a right ischial pressure injury a few months postoperatively, which persisted despite nonoperative measures. He subsequently underwent an ipsilateral transiliac-shortening osteotomy 16 months after spinal surgery to treat his residual pelvic obliquity and the ischial pressure injury, which healed completely. At the 1-year follow-up visit, there were no further signs of pressure injury. Conclusion: This case report describes transiliac-shortening osteotomy as a viable treatment option for non-healing ischial pressure injuries secondary to fixed pelvic obliquity.

PMID: 38758928

3. Can on-line gait training improve clinical practice? Study protocol for feasibility randomised controlled trial of an on-line educational intervention to improve clinician's gait-related decision-making in ambulant children and young people with cerebral palsy

Anna Hebda-Boon, Adam P Shortland, Aleksandra Birn-Jeffery, Dylan Morrissey

Pilot Feasibility Stud. 2024 May 14;10(1):76. doi: 10.1186/s40814-024-01477-5.

Background: Instrumented gait analysis (IGA) is an assessment and research tool with proven impacts on clinical decision-making for the management of ambulant children and young people with cerebral palsy (CYPwCP) but is underused and variably understood by relevant clinicians. Clinicians' difficulties in gaining expertise and confidence in using IGA are multifactorial and related to access for clinical decision-making, limited training opportunities and inability to translate this training into clinical practice. Methods: The primary aim of this study is to test the feasibility of an educational intervention to advance clinicians' application of gait analysis in CYPwCP, to inform a definitive trial. The secondary aim is to measure the

effect that appropriate IGA training has on physiotherapists' knowledge, skills, confidence and behaviours. This will be a two-arm feasibility randomised controlled trial with an experimental and control group. The 6-week on-line intervention uses a multicomponent approach grounded in behavioural change techniques. A repeated measures design will be adopted, whereby participants will complete outcome measures at baseline, immediately after the intervention and at 4 months. The primary outcome measures (trial feasibility-related outcomes) are recruitment and engagement. The secondary outcome measures (trial research-related outcomes) are knowledge, skills, confidence and practice change. Outcome measures will be collected via online questionnaires and during observed skill assessments. Analysis of data will use descriptive statistics, two-way mixed ANOVA model and qualitative content analysis. Discussion: This study will determine feasibility of the definitive randomised control trial of educational intervention delivered to advance clinicians' application of gait analysis in CYPwCP. This study offers the shift in emphasis from regarding IGA as a tool to a focus on clinicians' requirements for access, training and a well-defined role to optimise utilisation of IGA. The impact of this should be better engagement with IGA and clinical practice change. This study will contribute to a body of educational research into clinical education of healthcare professionals and IGA training offering insight into high levels of evaluation evidence including clinical behaviour change. Trial registration: Protocol has been registered with the Open Science Framework (osf.io/nweq6) in June 2023.

PMID: 38745259

4. Is functional mobility associated with quality of sitting in cerebral palsy? A cross-sectional study

Kaiorisa Doctor, Shreekanth D Karnad, Shyam Krishnan, Amitesh Narayan, Akshatha Nayak

J Neurosci Rural Pract. 2024 Apr-Jun;15(2):286-292. doi: 10.25259/JNRP_516_2023. Epub 2024 Feb 28.

Objectives: A group of neuromuscular system anomalies associated with non-progressive issues in the developing fetal or newborn brain are known as cerebral palsy (CP). These abnormalities are typified by poor posture and motor development, which limits the execution of functional activities. Consequently, to achieve the same goals as peers who are typically developing, children with CP employ a variety of compensatory postures and techniques. Given that both sitting and mobility are essential for functioning, assessing each skill alone and in relation to the other is necessary. This study aims to determine if a child's functional mobility affects their sitting ability. Materials and methods: Twenty CP (Gross Motor Function Classification System [GMFCS] levels I and II) children, aged 6-12, were enrolled in the research. The level of sitting scale (LSS) and the modified timed up and go (mTUG) test were utilized to evaluate sitting and functional mobility, respectively. Results: The quality of sitting was shown to have a substantial effect on functional mobility, as a significant difference in mTUG durations was established between LSS levels ($P < 0.001$) and persisted when analyzed within the same GMFCS level ($P = 0.007$). Conclusion: The importance of trunk control in functional mobility can be inferred from the link between sitting quality and mobility. To improve children with CP's functional mobility, this evidence may be utilized to design a well-informed and specific intervention program incorporating trunk control.

PMID: 38746505

5. Measuring Physical Activity in Children Who Do Not Walk and With Cerebral Palsy: An Exploratory Case Series

Nia Toomer-Mensah, Margaret O'Neil, Miguel Blacutt, Lori Quinn

Pediatr Phys Ther. 2024 May 16. doi: 10.1097/PEP.0000000000001113. Online ahead of print.

Aim: The purpose of this case series was to describe physical activity (PA) amount and intensity in the home and school environment. Accelerometers and heart rate (HR) monitors are reliable and valid measures of PA in children with cerebral palsy (CP) who can walk. There is limited research on PA measures in children with CP who cannot walk. Methods: Three 9-year-old boys with CP, Gross Motor Function Classification System levels IV and V, participated in a 1-week measurement period wearing waist- and wrist-worn triaxial accelerometers to measure PA counts and a wrist-worn HR monitor to measure PA intensity. PA intensity was calculated using an estimated HR max. Accelerometer counts were reported. Parents and school staff completed activity and eating journals. Results: Six days of PA and HR data were analyzed. Two participants spent more time in moderate/vigorous PA intensity during school compared to at home. Activities with greatest PA intensity included oral eating, communication, and social engagement. Higher activity counts were recorded from the wrist compared with the waist accelerometers. PA and eating journal adherence were high in both settings. Conclusion: The findings provide preliminary data to evaluate PA amount and intensity in children with CP who have little walking ability. It is important to consider PA levels in daily activity for youth with CP when designing plans of care.

PMID: 38758603

6. Home-based motorised cycling in Non-ambulant adults with cerebral palsy: a feasibility study

Carlee Holmes, Nora Shields, Prue Morgan, Kim Brock, Georgia McKenzie, Dinah Reddihough

Disabil Rehabil. 2024 May 16:1-9. doi: 10.1080/09638288.2024.2353234. Online ahead of print.

Purpose: The primary aim was to establish feasibility of a home-based motorised cycling intervention in non-ambulant adults with cerebral palsy (CP). The secondary aim was to investigate perceived outcomes on pain, sleep, fatigue, and muscle stiffness. Materials and method: Non-ambulant adults with CP were recruited from a specialist clinic. Feasibility encompassing recruitment, retention, adherence, acceptability, practicality, and safety, was the primary outcome., Cycling frequency and duration data were downloaded from the device and augmented by a usage diary and participant survey. Participant satisfaction was rated using a 5-point Likert scale where 1 = very satisfied. Quantitative data and open-ended survey responses were analysed using descriptive statistics and content analysis, respectively. Results: Ten non-ambulant adults with CP (5 female), 18 to 32 years, participated. The median (IQR) days cycled per week was 4 (3,5) with no serious adverse events recorded. The median (IQR) time cycled per session was 13.9 min, (10.2,19.8), per day. Participant satisfaction was high, median (IQR) 2 (1,2.5). Perceived benefits in pain, sleep, fatigue, stiffness, leg function, mood, behaviour, and social interactions were reported alongside occasional problems with spasms and foot placement. Conclusion: This study provides preliminary data to support the feasibility of motorised cycling for non-ambulant adults with CP.

PMID: 38756006

7. Adults with cerebral palsy exhibit uncharacteristic cortical oscillations during an adaptive sensorimotor control task

Erica H Hinton, Morgan T Busboom, Christine M Embury, Rachel K Spooner, Tony W Wilson, Max J Kurz

Sci Rep. 2024 May 11;14(1):10788. doi: 10.1038/s41598-024-61375-x.

Prior research has shown that the sensorimotor cortical oscillations are uncharacteristic in persons with cerebral palsy (CP); however, it is unknown if these altered cortical oscillations have an impact on adaptive sensorimotor control. This investigation evaluated the cortical dynamics when the motor action needs to be changed "on-the-fly". Adults with CP and neurotypical controls completed a sensorimotor task that required either proactive or reactive control while undergoing magnetoencephalography (MEG). When compared with the controls, the adults with CP had a weaker beta (18-24 Hz) event-related desynchronization (ERD), post-movement beta rebound (PMBR, 16-20 Hz) and theta (4-6 Hz) event-related synchronization (ERS) in the sensorimotor cortices. In agreement with normative work, the controls exhibited differences in the strength of the sensorimotor gamma (66-84 Hz) ERS during proactive compared to reactive trials, but similar condition-wise changes were not seen in adults with CP. Lastly, the adults with CP who had a stronger theta ERS tended to have better hand dexterity, as indicated by the Box and Blocks Test and Purdue Pegboard Test. These results may suggest that alterations in the theta and gamma cortical oscillations play a role in the altered hand dexterity and uncharacteristic adaptive sensorimotor control noted in adults with CP.

PMID: 38734783

8. Modified sports interventions for children and adolescents with disabilities: A scoping review

Ricardo Rodrigues de Sousa Junior, Alice Bustamante Sousa, Arthur Felipe Barroso de Lima, Rebeca de Barros Santos-Rehder, Camila Rocha Simão, Gabriela Fischer, Ana Cristina Resende Camargos, Georgina L Clutterbuck, Hércules Ribeiro Leite

Review Dev Med Child Neurol. 2024 May 12. doi: 10.1111/dmcn.15952. Online ahead of print.

Aim: To establish the scope of the literature on modified sports interventions for children and adolescents with disabilities. Method: For this scoping review, articles were screened and the characteristics of studies were extracted. The modified sports interventions were described in terms of their structure, using the items of the Template for Intervention Description and Replication. Components of intervention treatment were described by using the language of the Rehabilitation Treatment Specification System. Results were analysed and validated by a group of professionals, using the Public and Patient Involvement strategy. Results: Twelve studies were eligible for inclusion, investigating interventions for children with autism spectrum disorder, cerebral palsy, and other conditions. Most studies presented a moderate level of evidence. Active ingredients were repeated sports-related motor training and introduction to the sport through a 'learning by action' mechanism. The intervention target was gross motor skills performance, and intervention aims (indirect outcomes) were physical activity participation and different body functions. Interpretation: The inclusion of stakeholders in this review helped to validate our findings about the characteristics and structure of modified sports interventions, to identify research gaps, and to provide a step process for clinical implementation. Future investigations are warranted of the effectiveness of modified sports investigations with better quality studies, including participation outcomes and studies with non-ambulant children.

PMID: 38736257

9. Implementation and Clinical Outcomes of Blood Flow Restriction Training on Adults With Cerebral Palsy: A Case Series

Christopher Joyce, Brendan Aylward, Nicholas Rolnick, Steven Lachowski

J Neurol Phys Ther. 2024 May 17. doi: 10.1097/NPT.0000000000000475. Online ahead of print.

Background and purpose: Cerebral palsy (CP) is a congenital neurological disorder that causes musculoskeletal weakness and biomechanical dysfunctions. Strength training guidelines recommend at least 70% of 1-repetition maximum to increase muscle strength and mass. However, individuals with CP may not tolerate such high exercise intensity. Blood flow restriction (BFR) can induce similar gains in strength and muscle mass using loads as low as 20% to 30% 1-repetition maximum. This case series described the safety, feasibility, and acceptability of BFR in adults with CP and examined changes in muscle mass and strength. Case description: Three male participants with gross motor function classification system level 3 CP underwent strength training using a periodized 8-week BFR protocol. Outcomes included: Safety via blood pressure during and post-BFR exercises in addition to adverse event tracking; Feasibility via number of support people and time-duration of BFR exercises; Acceptability via rate of perceived discomfort (0-10) and qualitative interviews; Muscle Mass via ultrasonographic cross-sectional area of the quadriceps and hamstring; and Strength via (1) 3-repetition maximum in the leg press and knee extension, (2) isometric knee flexor and extensor muscle force measured with a hand-held dynamometer, and (3) 30-second sit-to-stand test. Intervention: Participants replaced 2 exercises from their current regimen with seated knee extension and leg press exercises using progressively higher limb occlusion pressure and exercise intensity. Limb occlusion pressure started at 60%, by week 4 progressed to 80%, and then remained constant. The exercise repetition scheme progressed from fixed nonfailure repetition sets to failure-based repetition sets. Outcomes: Blood pressure never exceeded safety threshold, and no adverse events were reported. The BFR training was time-consuming and resource-intensive, but well-tolerated by participants (rate of perceived discomfort with a mean value of 5.8, 100% protocol adherence). Strength, as measured by 3-repetition maximum testing and 30-second sit-to-stand test, increased, but isometric muscle force and muscle mass changes were inconsistent. Discussion: Blood flow restriction may be an effective means to increase strength in adults with CP who cannot tolerate high-intensity resistance training. Future research should compare BFR to traditional strength training and investigate mediators of strength changes in this population. Video abstract available: for more insights from the authors (see the Video, Supplemental Digital Content available at: http://links.lww.com/JNPT/A473).

PMID: 38757901

10. Physical and Psychosocial Benefits of Sports Participation Among Children and Adolescents with Chronic Diseases: A Systematic Review

Borja Sañudo, Antonio Jesús Sánchez-Oliver, Jesús Fernández-Gavira, Dominik Gaser, Nicola Stöcker, Miguel Peralta, Adilson Marques, Sofia Papakonstantinou, Chiara Nicolini, Christina Sitzberger

Sports Med Open. 2024 May 15;10(1):54. doi: 10.1186/s40798-024-00722-8.

Background: This study aims to identify sports interventions for children and adolescents (CaA) with chronic diseases and evaluate their impact on physical, psychological, and social well-being. The findings of this study will contribute to our understanding of the potential benefits of sports interventions for CaA with chronic diseases and inform future interventions to promote their overall health and well-being. Methods: A systematic review was conducted in eight databases. This systematic review followed PRISMA guidelines and utilized a comprehensive search strategy to identify studies on sport-based interventions for CaA with chronic diseases. The review included randomized controlled trials and observational studies that focused on physical and psychosocial outcomes. Results: We screened 10,123 titles and abstracts, reviewed the full text of 622 records, and included 52 primary studies. A total of 2352 participants were assessed with an average of 45 ± 37 participants per study. Among the included studies involving CaA with chronic diseases with an age range from 3 to 18 years, 30% (n = 15) autism spectrum disorders, 21% (n = 11) cerebral palsy, 19% (n = 10) were attention deficit hyperactivity disorder, and 17% (n = 9) obesity. Other diseases included were cancer (n = 5), asthma (n = 1) and cystic fibrosis (n = 1). Interventions involved various sports and physical activities tailored to each chronic disease. The duration and frequency of interventions varied across studies. Most studies assessed physical outcomes, including motor performance and physical fitness measures. Psychosocial outcomes were also evaluated, focusing on behavioural problems, social competencies, and health-related quality of life. Conclusion: Overall, sport-based interventions effectively improved physical and psychosocial outcomes in CaA with chronic diseases. Interventions are generally safe, and participants adhere to the prescribed protocols favorably. Despite that, there is little evidence that interventions are being implemented. Future studies should include interventions tailored to meet the common issues experienced by CaA with chronic conditions, providing a comprehensive understanding of the impact of sports interventions on those affected. Registration: The methodology for this review was pre-determined and registered in the PROSPERO database (registration number: CRD42023397172).

PMID: 38750266

11. A second dimension of somatosensory system injury? Thalamic volume loss and neuropathic pain in adults with cerebral palsy and periventricular white matter injury

Eric M Chin, Nicole Gorny, James J Pekar, Claudia M Campbell, Martin Lindquist, Colleen Lenz, Alexander H Hoon Jr, Lauren L Jantzie, Shenandoah Robinson

Ann Child Neurol Soc. 2023 Dec;1(4):305-311. doi: 10.1002/cns3.20047. Epub 2023 Nov 30.

Objectives: Lemniscal (motor-related) and spinothalamic (neuropathic pain-related) somatosensory abnormalities affect different subsets of adults with cerebral palsy (CP). Lemniscal/motor abnormalities are associated with posterior thalamic radiation white matter disruption in individuals with CP and white matter injury. We tested the hypothesis that neuropathic pain symptoms in this population are rather associated with injury of the somatosensory (posterior group nuclei) thalamus. Methods: In this cross-sectional study, communicative adults with CP and bilateral white matter injury and neurotypical control participants volunteered to self-report pain symptoms and undergo research MRI. Posterior group thalamic nuclei volume was computed and correlated against neuropathic pain scores. Results: Participants with CP (n=6) had, on average, 24% smaller posterior group thalamic volumes (95% CI [10-39%]; corrected p=0.01) than control participants. More severe volume loss was correlated with more severe neuropathic pain scores (ρ=-0.87 [-0.99,-0.20]; p=0.02). Discussion: Association with thalamic volume loss suggests that neuropathic pain in adults with CP may frequently be central neuropathic pain. Complementing assessments of white matter microstructure, regional brain volumes hold promise as diagnostic biomarkers for central neuropathic pain in individuals with structural brain disorders.

PMID: 38746788

12. Disease-Agnostic Electronic Adherence Aid for Subcutaneous at-Home and Self-Administration Devices-The Lowest Common Denominator Based on a Cross-Indication Survey

Beate Bittner, Francisco Javier Munoz, James Odonoghue, Jose Manuel Ordonez, Johannes Schmidt, Kathrin Schmitt, Katja Stassen

ACS Pharmacol Transl Sci. 2024 Apr 26;7(5):1310-1319. doi: 10.1021/acsptsci.3c00377. eCollection 2024 May 10.

The value of connected devices and health apps with features such as adherence trackers, dosing reminders, and remote communication tools for users and healthcare providers has been assessed to support home-based subcutaneous administration. A comprehensive survey was conducted with 605 participants, including users and caregivers, from eight countries. Medical conditions encompassed ankylosing spondylitis, asthma, cerebral palsy, cluster headaches, Crohn's disease, hemophilia, lupus, migraine, multiple sclerosis, Parkinson's disease, plaque psoriasis, psoriatic arthritis, rheumatoid arthritis, spasticity, spondyloarthritis, and ulcerative colitis. Utilizing a maximum difference scaling methodology, the survey gauged participant preferences regarding specific attributes and features of connected drug delivery devices. Irrespective of demographic factors like age, gender, nationality, or the specific medical condition, the device's ability to verify a successful injection stood out as universally valued. The second and third most valued attributes pertained to temperature-related indicators or warnings. These features do not necessitate the use of a connected device and can be integrated into existing autoinjector platforms. The survey findings support the development of a universal adherence tool for at-home subcutaneous dosing, independent of a specific medical condition. This tool may be gradually improved with disease-specific features. Once established as a platform, manufacturers can launch any subcutaneous medication and later integrate real-world evidence for enhanced educational, treatment, and diagnostic capabilities. This approach is crucial for advancing connected adherence tools in decentralized healthcare, aligning with user and healthcare system needs while translating scientific innovation into practical solutions.

PMID: 38751643

13. Electroacupuncture stimulation modulates functional brain connectivity in the treatment of pediatric cerebral palsy: a case report

Zongbo Sun, Chenglin Li, Laixin Sun, Wenwen Yang, Xueli Qu, Yuanyuan Li, Xiao Duan, Fengyu Guo, Xuejing Sun, Mingzhu Yang, Tong Qi, Longyun Zhu, Shuai Wang, Yu Xia, Yanan Du, Shuhui Luo, Lingling Li, Yu Gu, Yaya Wang, Li Yang

Case Reports Front Psychiatry. 2024 Apr 22:15:1392958. doi: 10.3389/fpsyt.2024.1392958. eCollection 2024.

Background: Pediatric cerebral palsy (CP) is a non-progressive brain injury syndrome characterized by central motor dysfunction and insufficient brain coordination ability. The etiology of CP is complex and often accompanied by diverse complications such as intellectual disability and language disorders, making clinical treatment difficult. Despite the availability of pharmacological interventions, rehabilitation programs, and spasticity relief surgery as treatment options for CP, their effectiveness is still constrained. Electroacupuncture (EA) stimulation has demonstrated great improvements in motor function, but its comprehensive, objective therapeutic effects on pediatric CP remain to be clarified. Methods: We present a case of a 5-year-old Chinese female child who was diagnosed with CP at the age of 4. The patient exhibited severe impairments in motor,

language, social, and cognitive functions. We performed a 3-month period of EA rehabilitation, obtaining resting state functional magnetic resonance imaging (rs-fMRI) of the patient at 0 month, 3 months and 5 months since treatment started, then characterized brain functional connectivity patterns in each phase for comparison. Results: After a 12-month follow-up, notable advancements were observed in the patient's language and social symptoms. Changes of functional connectivity patterns confirmed this therapeutic effect and showed specific benefits for different recovery phase: starting from language functions then modulating social participation and other developmental behaviors. Conclusion: This is a pioneering report demonstrating the longitudinal effect of EA stimulation on functional brain connectivity in CP patients, suggesting EA an effective intervention for developmental disabilities (especially language and social dysfunctions) associated with pediatric CP.

PMID: 38751414

14. A survey on the short to medium-term satisfaction of neurological patients treated by functional surgery for the correction of limb deformities

Paolo Zerbinati, Davide Mazzoli, Martina Galletti, Giacomo Basini, Chiara Rambelli, Francesca Mascioli, Maria Chiara Bò, Caterina Delia, Ludovica Petroselli, Maria Chiara Vulpiani, Paolo Prati, Jonathan Bemporad, Andrea Merlo

Curr Med Res Opin. 2024 May 17:1-18. doi: 10.1080/03007995.2024.2352855. Online ahead of print.

Objectives: Functional surgery (FS) is often used to correct congenital or acquired deformities in neurological patients. Along with functional results, short- and medium-term patient satisfaction should always be considered a key goal of surgery and rehabilitation. The aim of this study is to assess the short to medium-term satisfaction of patients who underwent FS and its correlation with perceived improvements. Methods: Invitation to an anonymous online survey was sent via e-mail to all neurological adult patients or caregivers of children who underwent lower or upper limb FS over the 2018 - 2020 period. The survey investigated patients' satisfaction with the surgery and the variation in pain, ADLs, level of independence, body image, self-esteem, social interaction skills, participation in social events, leisure activities and sports, and use of orthoses or walking aids. Descriptive data analysis was performed. Correlations were assessed using Kendall's tau. Results: 122 out of 324 adults and 53 out of 163 children's caregivers filled out the questionnaire, with a response rate approaching 40%. Eighty-three percent of adult respondents and 87% of the children's caregivers were satisfied or very satisfied in the short and medium terms and reported their expectations had been met. Satisfaction was significantly correlated ($p < 0.01$) with improvements in functional abilities, social participation, self-esteem, and pain reduction. Half of the adults and 40% of children stopped using their orthoses or replaced them with lighter ones. Dissatisfaction and worsened conditions were reported by <10% of the respondents. Conclusion: According to patients and caregivers, FS was satisfactory in the short and medium terms, following improvements in all the ICF domains for most patients.

PMID: 38756086

15. Risk Factors for Perinatal Arterial Ischemic Stroke: A Machine Learning Approach

Ratika Srivastava, Lauran Cole, Kimberly Amador, Nils Daniel Forkert, Mary Dunbar, Michael I Shevell, Maryam Oskoui, Anna P Basu, Michael J Rivkin, Eilon Shany, Linda S de Vries, Deborah Dewey, Nicole Letourneau, Pauline Mouches, Michael D Hill, Adam Kirton

Neurology. 2024 Jun;102(11):e209393. doi: 10.1212/WNL.0000000000209393. Epub 2024 May 15.

Background and objectives: Perinatal arterial ischemic stroke (PAIS) is a focal vascular brain injury presumed to occur between the fetal period and the first 28 days of life. It is the leading cause of hemiparetic cerebral palsy. Multiple maternal, intrapartum, delivery, and fetal factors have been associated with PAIS, but studies are limited by modest sample sizes and complex interactions between factors. Machine learning approaches use large and complex data sets to enable unbiased identification of clinical predictors but have not yet been applied to PAIS. We combined large PAIS data sets and used machine learning methods to identify clinical PAIS factors and compare this data-driven approach with previously described literature-driven clinical prediction models. Methods: Common data elements from 3 registries with patients with PAIS, the Alberta Perinatal Stroke Project, Canadian Cerebral Palsy Registry, International Pediatric Stroke Study, and a longitudinal cohort of healthy controls (Alberta Pregnancy Outcomes and Nutrition Study), were used to identify potential predictors of PAIS. Inclusion criteria were term birth and idiopathic PAIS (absence of primary causative medical condition). Data including maternal/pregnancy, intrapartum, and neonatal factors were collected between January 2003 and March 2020. Common data elements were entered into a validated random forest machine learning pipeline to identify the highest predictive features and develop a predictive model. Univariable analyses were completed post hoc to assess the relationship between each predictor and outcome. Results: A machine learning model was developed using data from 2,571 neonates, including 527 cases (20%) and 2,044 controls (80%). With a mean of 21 features selected, the random forest machine learning approach predicted the outcome with approximately 86.5% balanced accuracy. Factors that were selected a priori through literature-driven variable selection that were also identified as most important by the machine learning model were maternal age, recreational substance exposure, tobacco exposure, intrapartum maternal fever, and low Apgar score at 5 minutes. Additional variables identified through machine learning included in utero alcohol exposure, infertility, miscarriage, primigravida, meconium, spontaneous vaginal delivery, neonatal head circumference, and 1-minute Apgar score. Overall, the machine learning model performed

better (area under the curve [AUC] 0.93) than the literature-driven model (AUC 0.73). Discussion: Machine learning may be an alternative, unbiased method to identify clinical predictors associated with PAIS. Identification of previously suggested and novel clinical factors requires cautious interpretation but supports the multifactorial nature of PAIS pathophysiology. Our results suggest that identification of neonates at risk of PAIS is possible.

PMID: 38748936

16. Important Considerations for Diagnosing and Managing Neonatal Ischemic Stroke

Jenny L Wilson, Alison Christy, Alexis N Simpkins

Stroke. 2024 May 15. doi: 10.1161/STROKEAHA.124.046992. Online ahead of print.

No abstract available

PMID: 38747168

17. Caffeine improves mitochondrial dysfunction in the white matter of neonatal rats with hypoxia-ischemia through deacetylation: a proteomic analysis of lysine acetylation

Yajun Zhang, Yuqian Wang, Haiping Dou, Shanshan Wang, Danyang Qu, Xin Peng, Ning Zou, Liu Yang

Front Mol Neurosci. 2024 Apr 30:17:1394886. doi: 10.3389/fnmol.2024.1394886. eCollection 2024.

Aims: White matter damage (WMD) is linked to both cerebral palsy and cognitive deficits in infants born prematurely. The focus of this study was to examine how caffeine influences the acetylation of proteins within the neonatal white matter and to evaluate its effectiveness in treating white matter damage caused by hypoxia-ischemia. Main methods: We employed a method combining affinity enrichment with advanced liquid chromatography and mass spectrometry to profile acetylation in proteins from the white matter of neonatal rats grouped into control (Sham), hypoxic-ischemic (HI), and caffeine-treated (Caffeine) groups. Key findings: Our findings included 1,999 sites of lysine acetylation across 1,123 proteins, with quantifiable changes noted in 1,342 sites within 689 proteins. Analysis of these patterns identified recurring sequences adjacent to the acetylation sites, notably YKacN, FkacN, and G * * * GkacS. Investigation into the biological roles of these proteins through Gene Ontology analysis indicated their involvement in a variety of cellular processes, predominantly within mitochondrial locations. Further analysis indicated that the acetylation of tau (Mapt), a protein associated with microtubules, was elevated in the HI condition; however, caffeine treatment appeared to mitigate this over-modification, thus potentially aiding in reducing oxidative stress, inflammation in the nervous system, and improving mitochondrial health. Caffeine inhibited acetylated Mapt through sirtuin 2 (SITR2), promoted Mapt nuclear translocation, and improved mitochondrial dysfunction, which was subsequently weakened by the SIRT2 inhibitor, AK-7. Significance: Caffeine-induced changes in lysine acetylation may play a key role in improving mitochondrial dysfunction and inhibiting oxidative stress and neuroinflammation.

PMID: 38745725

18. Exploring early life social and executive function development in infants and risk for autism: a prospective cohort study protocol of NICU graduates and infants at risk for cerebral palsy

Kelsie A Boulton, Dabin Lee, Ingrid Honan, Natalie L Phillips, Catherine Morgan, Cathryn Crowle, Iona Novak, Nadia Badawi, Adam J Guastella

BMC Psychiatry. 2024 May 14;24(1):359. doi: 10.1186/s12888-024-05779-z.

Background: Delays in early social and executive function are predictive of later developmental delays and eventual neurodevelopmental diagnoses. There is limited research examining such markers in the first year of life. High-risk infant groups commonly present with a range of neurodevelopmental challenges, including social and executive function delays, and show higher rates of autism diagnoses later in life. For example, it has been estimated that up to 30% of infants diagnosed with cerebral palsy (CP) will go on to be diagnosed with autism later in life. Methods: This article presents a protocol of a prospective longitudinal study. The primary aim of this study is to identify early life markers of delay in social and executive function in high-risk infants at the earliest point in time, and to explore how these markers may relate to the increased risk for social and executive delay, and risk of autism, later in life. High-risk infants will include Neonatal Intensive Care Unit (NICU) graduates, who are most commonly admitted for premature birth and/or cardiovascular problems. In addition, we will include infants with, or at risk for, CP. This prospective study will recruit 100 high-risk infants at the age of 3-12 months old and will track social and executive function across the first 2 years of their life, when infants are 3-7, 8-12, 18 and 24 months old. A multi-modal approach will be adopted by tracking the early development of social and executive function using behavioural, neurobiological, and caregiver-reported everyday functioning markers. Data will be analysed to assess the relationship between the early markers, measured from as early as 3-7 months of age, and the social and executive function as well as the autism

outcomes measured at 24 months. Discussion: This study has the potential to promote the earliest detection and intervention opportunities for social and executive function difficulties as well as risk for autism in NICU graduates and/or infants with, or at risk for, CP. The findings of this study will also expand our understanding of the early emergence of autism across a wider range of at-risk groups.

PMID: 38745143

19. Resting-state functional connectivity in children cooled for neonatal encephalopathy

Arthur P C Spencer, Marc Goodfellow, Ela Chakkarapani, Jonathan C W Brooks

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Therapeutic hypothermia improves outcomes following neonatal hypoxic-ischaemic encephalopathy, reducing cases of death and severe disability such as cerebral palsy compared with normothermia management. However, when cooled children reach early school-age, they have cognitive and motor impairments which are associated with underlying alterations to brain structure and white matter connectivity. It is unknown whether these differences in structural connectivity are associated with differences in functional connectivity between cooled children and healthy controls. Resting-state functional MRI has been used to characterize static and dynamic functional connectivity in children, both with typical development and those with neurodevelopmental disorders. Previous studies of resting-state brain networks in children with hypoxic-ischaemic encephalopathy have focussed on the neonatal period. In this study, we used resting-state fMRI to investigate static and dynamic functional connectivity in children aged 6-8 years who were cooled for neonatal hypoxic-ischaemic without cerebral palsy [n = 22, median age (interquartile range) 7.08 (6.85-7.52) years] and healthy controls matched for age, sex and socioeconomic status [n = 20, median age (interquartile range) 6.75 (6.48-7.25) years]. Using group independent component analysis, we identified 31 intrinsic functional connectivity networks consistent with those previously reported in children and adults. We found no case-control differences in the spatial maps of these intrinsic connectivity networks. We constructed subject-specific static functional connectivity networks by measuring pairwise Pearson correlations between component time courses and found no case-control differences in functional connectivity after false discovery rate correction. To study the time-varying organization of resting-state networks, we used sliding window correlations and deep clustering to investigate dynamic functional connectivity characteristics. We found k = 4 repetitively occurring functional connectivity states, which exhibited no case-control differences in dwell time, fractional occupancy or state functional connectivity matrices. In this small cohort, the spatiotemporal characteristics of resting-state brain networks in cooled children without severe disability were too subtle to be differentiated from healthy controls at early school-age, despite underlying differences in brain structure and white matter connectivity, possibly reflecting a level of recovery of healthy resting-state brain function. To our knowledge, this is the first study to investigate resting-state functional connectivity in children with hypoxic-ischaemic encephalopathy beyond the neonatal period and the first to investigate dynamic functional connectivity in any children with hypoxic-ischaemic encephalopathy.

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20. Long-term outcome safety assessment after teleneuromodulation in children with cerebral palsy

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No abstract available

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21. The processes and outcomes related to 'family-centred care' in neuromotor and functional rehabilitation contexts for children with cerebral palsy: A scoping review

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Objective: The aim of this study is to identify the main processes and outcomes related to family-centred care (FCC) in neuromotor and functional rehabilitation of preschool children with cerebral palsy (CP). Background: FCC is considered a reference for best practices in child rehabilitation. CP is the most common cause of physical disability in childhood with repercussions on functionality. There is a gap in knowledge of the practical principles of FCC, and it is necessary to develop a reference model for the practice of child rehabilitation professionals. Methods: In this scoping review, the main databases selected were as follows: LILACS; Pubmed; Embase; The Cochrane Library; CINAHL (EBSCO); Scopus; Web of Science;

PEDro (Physiotherapy Evidence Database); Open Gray and other banks of thesis. The terms combined in the search strategy were as follows: 'Family-centered', 'Family-centred' and 'CP'. Inclusion criteria are as follows: studies on preschool-aged children with CP, undergoing family-centred functional therapeutic interventions (FCFTI) with outcomes on bodily structures and functions and/or activities and/or participation. Results: The main participatory care methods identified were home intervention, environmental enrichment, collaborative realistic goal setting, planning of home-based activities and routine, child assessment feedback, family education/training, family coaching, encouraging discussion, observation of therapist and supervised practice. The main relational care qualities identified were as follows: respect, active listening, treat parents as equals, clear language, respect parents' ability to collaborate, demonstrate genuine care for the family, appreciate parents' knowledge and skills, demonstrate competence, experience and commitment. The main outcomes identified in children were improvement in motor and cognitive function and the child's functional ability. The main parentaloutcomes identified were empowerment, feeling of competence, self-confidence, motivation and engagement. Conclusion: The main differences in FCFTI programs refer to the parental education/guidance component and the amount of intervention carried out by parents. It is possible that the elements chosen by the therapist in a FCFTI depend on characteristics of the child and caregivers.

PMID: 38738842

22. A Comparison of the Functioning and Disability Levels of Children With Hemiplegic and Diplegic Cerebral Palsy Based on ICF-CY Components

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We compared children with hemiplegic and diplegic cerebral palsy (CP) using the conceptual framework of the International Classification of Functioning, Disability and Health: Child and Youth version (ICF-CY). We enrolled 42 children with CP aged 5 - 13 years old (M age = 9.57, SD = 2.8 years). We assessed their trunk control and dynamic balance with the Trunk Control Measurement Scale (TCMS) and the Timed Up and Go test (TUG), and we used ABILHAND-Kids and Assessment of Life Habits (Life-H) to assess their manual ability and participation with activities of daily living. We administered the European Child Environment Questionnaire (ECEQ) to identify relevant environmental factors. We employed structural equation modeling (SEM) to identify specific factors contributing to potential differences between these CP groups. Children with hemiplegic CP demonstrated significantly better outcomes in terms of trunk control, dynamic balance, and environmental factors compared to those with diplegic CP ($p < .05$). In contrast, children with diplegic CP demonstrated superior outcomes regarding manual ability, compared to those with hemiplegic CP ($p < .001$). In our structural equation models, trunk control strongly predicted both dynamic balance (0.75) and environmental factors (0.74). Moreover, the relationships between trunk control and participation in daily and social activities were 0.54 and 0.47, respectively. Impaired trunk control and dynamic balance were significant contributors to increased activity restrictions and environmental barriers in children with diplegic CP. This suggests that improving disability and functioning in children with diplegic CP requires a focus on trunk control training and dynamic balance exercises.

PMID: 38736155

23. A neuropsychiatric case of delayed post-hypoxic leukoencephalopathy from opioid intoxication resulting in Anton-Babinski syndrome and quadriplegia

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This is the case of a 26-year-old male who developed Anton Babinski syndrome (ABS), quadriplegia, and delayed post-hypoxic leukoencephalopathy (DPHL) after an opioid overdose. He exhibited cortical blindness, visual anosognosia, and confabulation upon awakening. Several days later, he experienced acute psychosis and agitation. T2-FSE MRI revealed extensive supratentorial leukoencephalopathy involving both cerebral hemispheres, extending to the posterior corpus callosum due to cerebral anoxia. This case report will discuss different types of encephalopathy from opioid abuse, ABS, visual anosognosia, and confabulation's pathogenic mechanisms. It underscores the necessity of researching substance-induced neuropsychiatric disorders and their pathogenic mechanisms for effective treatments.

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